WHAT IS CLAIMED IS:

1. An implantable amplifying circuit for ENG recording of neural signals obtained from nerve electrodes, comprising:

an input terminal for receiving said signals;

an output terminal;

nerve protection circuitry connected to said input terminal;

a pre-amplifier having an input connected to an output of said nerve protection circuitry;

an amplifier having an input connected to an output of said pre-amplifier.

2. The implantable amplifying circuit of claim 1 further comprising a DC restoration circuit having an input connected to an output of said amplifier, and having an output connected to said output terminal.

3. The implantable amplifying circuit of claim 1, further comprising a second input terminal for receiving said signals, wherein said nerve protection circuitry is also connected to said second input terminal.

4. The implantable amplifying circuit of claim 3, wherein said nerve protection circuitry further comprises a second output, and said pre-amplifier further comprises a second input connected to said second output of said nerve protection circuitry.

5. The implantable amplifying circuit of claim 4 wherein said nerve protection circuitry comprises:

a first capacitor in series between said first input terminal and said first input to said pre-amplifier;

a second capacitor in series between said second input terminal and said second input to said pre-amplifier;

a first resistor connected in shunt configuration between said first input to said pre-amplifier and a connection point;

a second resistor connected in shunt configuration between said second input to said pre-amplifier and said connection point; and,

a third resistor connected between said connection point and a reference voltage terminal providing a virtual ground terminal in respect of said implantable amplifying circuit.

6. The implantable amplifying circuit of claim 1 wherein said nerve protection circuitry comprises a resistor in parallel with one or more capacitors in series, said parallel pair connected between a body ground and a reference voltage terminal providing a virtual ground terminal in respect of said implantable amplifying circuit.

7. The implantable amplifying circuit of claim 1 wherein said pre-amplifier comprises:

a low-noise CMOS differential difference input stage having a difference signal output;

a gain stage coupled to receive a difference signal from the difference signal output wherein the difference signal obtained from the input stage is converted to a single-ended signal;

a low-power output stage with low output resistance following the gain stage; and

a feedback network connected between the output and input stages.

8. The implantable amplifying circuit of claim 1 wherein said amplifier is a band-pass amplifier.

9. The implantable amplifying circuit of claim 8 wherein said band-pass amplifier comprises a plurality of high-pass filters and a plurality of low-pass negative-feedback amplifiers alternatingly cascaded with said high-pass filters.

10. The implantable amplifying circuit of claim 9 wherein said band-pass amplifier is a programmable-gain band-pass amplifier.

11. The implantable amplifying circuit of claim 10, wherein each low-pass negative-feedback amplifier comprises:

a plurality of series-connected resistors forming a resistor string connected between an output terminal and a voltage reference terminal of the low-pass negative-feedback amplifier; and

a plurality of selectable switches wherein an end of each selectable switch is connected to an input terminal of the low-pass negative-feedback amplifier and another end of each selectable switch is connected to a nodal point between the resistors in the resistor string.

12. The implantable amplifying circuit of claim 9, wherein each low-pass negative-feedback amplifier comprises an output stage in Darlington configuration operating as class AB amplifier wherein a bias circuit supplying bias to the output stage also carries signal current.

13. The implantable amplifying circuit of claim 1, wherein said programmable-gain band-pass amplifier has a frequency range between approximately 900 Hz and 9 kHz for 5 μV_{peak} input neural signals.

14. The implantable amplifying circuit of claim 1, wherein an equivalent input noise at 3 kHz is lower than 0.6 μV_{rms}.

15. The implantable amplifying circuit of claim 1, having a CMRR higher than 90 dB at 250 Hz.

16. The implantable amplifying circuit of claim 1, having a power consumption lower than 12 mW.

17. The implantable amplifying circuit of claim 1, wherein said implantable amplifying circuit is powered by an RF telemetry link.

18. The implantable amplifying circuit of claim 17 having a PSRR higher than 85 dB at 3 kHz.

19. The implantable amplifying circuit of claim 1, wherein said implantable amplifying circuit is powered by a battery.

20. A pre-amplifier suitable for use in an implantable amplifying circuit, comprising:

a low-noise CMOS differential difference input stage having a difference signal output;

a gain stage coupled to receive a difference signal from the difference signal output wherein the difference signal obtained from the input stage is converted to a single-ended signal;

a low-power output stage with low output resistance following the gain stage; and

a feedback network connected between the output and input stages.

21. The pre-amplifier of claim 20, wherein the low-noise CMOS differential difference input stage comprises two differential pairs comprised of PMOS transistors biased to operate in a weak inversion region.

22. The pre-amplifier of claim 20, wherein the PMOS transistors have a common-centroid crossed-coupled layout.

23. The pre-amplifier of claim 20, wherein the gain stage comprises an amplifier in cascode configuration in which a capacitor, connected between the gates of transistors forming a cascode current mirror circuit and a voltage reference, improves PSRR.

24. The pre-amplifier of claim 20, wherein the low-power output stage with low output resistance comprises an equivalent Darlington pnp transistor.

25. The pre-amplifier of claim 20, wherein the feedback network comprises integrated resistors.

26. An implantable signal carrying circuit comprising:
an input for coupling to an implanted electrode;
an amplifying circuit comprising a CMOS input stage; and,
a protection circuit comprising a high-pass filter coupling the input to the amplifying circuit.

27. The implantable signal carrying circuit of claim 26 wherein the CMOS input stage comprises a pair of CMOS transistors having a common-centroid crossed-coupled layout.

28. A nerve protection circuit suitable for use in an implantable amplifying circuit having a pre-amplifier with high input impedance, comprising a resistor in parallel with one or more capacitors in series, said parallel pair connected between a body ground and a reference voltage terminal providing a virtual ground terminal in respect of said pre-amplifier.

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